Appendix F
General Tips for Using Landscaping to Maximize Water Quality Benefits

Plant Materials

Plant materials used for stormwater quality facilities are generally grasses or plants associated with native wetlands. Grasses vary in their water requirements and may require irrigation during dry periods. While native wetland plants are well-adapted to the climatic and hydrologic conditions of the Northwest, temporary irrigation is prudent to ensure proper establishment during the first two years after planting. It is important that any native plant materials specified for a project be propagated by approved wetland nurseries. Be aware that in certain environmentally sensitive and greenway zones, the local permitting agency may require the use of approved plants.

A recommended plant list for the *Intermountain West* is provided at the end of this appendix.

Planting Season

Coordinate landscape operations and other site construction work to take advantage of favorable planting and seeding seasons. Plant wetland and riparian rootstock and bare root material during winter dormancy between October and April, taking care to avoid freezing periods. The optimal period for vegetation control and revegetation is following the irrigation season, when daytime temperatures are still above freezing. Seeded grasses are best planted during the spring and fall (April 1 - June 30; September 1 - October 30) and can often be established with minimal irrigation. Seeding from May 1 through August 31 will likely require scheduled irrigation. See the individual chapters throughout the Catalog for recommendations related to each stormwater facility type which uses vegetation.

Weed and Pest Control

Prepare the site to provide the best substrate for plant growth. Fertilizer, pesticide and herbicide use is not recommended, except in small amounts as needed for plant establishment. Prior to planting, weedy vegetation may be removed by mechanical methods including disking, harrowing, or scalping. Proper planning and use of native species should further avoid the need for pesticides, herbicides, or fertilizers for future long-term maintenance. When use cannot be avoided, application of these chemicals should be carried out by state-licensed applicators. Invasive seedlings from areas outside of the facility are usually best controlled by mowing or weeding.

Water retention and the possibility of creating mosquito habitat are a concern with some types of stormwater quality facilities, particularly heavily vegetated ponds and marshes. Installing bird and bat boxes will yield some control through natural predation. However, selective application

options include *Bacillus thurengiensis* formulations, juvenile hormone mimics such as Altosid ® formulations, and the use of predacious mosquitofish (*Gambusia affinis*). Mosquitofish may not be appropriate for all locations and have some restrictions on their use.

In areas where foraging by animals is a problem, protection with fencing or dense vegetation offers the most effective solution. Care must be taken to design facilities that protect and enhance habitat without endangering wildlife, particularly threatened and endangered species.

Mulches

During the establishment period, mulching the planted area is desirable to conserve water in the soil and to prevent erosion. Mulching of riparian and transition zone plants is required if planting occurs between September 1 and March 31. Select mulches based on the type of plantings, the erosion potential of the site, product availability, and cost. Avoid fresh sawdust and bark mulches, such as used in conventional landscape installations, due to potential toxicity to some young plants, a tendency to temporarily rob nitrogen from the soil as part of the decomposition process, and a tendency to become water-borne during storm events.

TECHNICAL NOTES

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IMPROVED GRASS, FORB, LEGUME AND WOODY SEED SPECIES FOR THE INTERMOUNTAIN WEST

This Technical Note was developed by Dan Ogle, Plant Materials Specialist, NRCS, Boise, Idaho. This is a literature review and includes narrative descriptions for species commonly seeded or planted throughout the intermountain west. The descriptions cover common name, scientific name, origin, sod verses bunch, life span, adaptation, seeding recommendations including vigor, ease of establishment, precipitation range, planting depth, seeds per square foot at one pound rate, recommended pure stand seeding rates and adapted cultivars or varieties for the intermountain west.

All seeding rates should be based on Pure Live Seed (PLS). These rates generally target 20-30 seeds/ft^2 and have been adjusted based on past research findings for establishing stands.

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IMPROVED GRASS, FORB, LEGUME AND WOODY SEED SPECIES FOR THE INTERMOUNTAIN WEST

DESCRIPTIONS OF SPECIES

CHARACTERISTICS OF GRASSES

Bentgrass *Agrostis* species

The genus including bentgrasses includes many species, usually perennial, often occurring on hydric soils. There are over 100 species worldwide including introduced species such as colonial bentgrass and creeping bentgrass which are important turf grasses. Approximately 20 species are native to North America. Common grasses found in wetland and riparian areas, redtop species, were probably introduced from Europe.

Bluegrass, Big *Poa ampla*

A medium-lived native bunchgrass which re-establishes itself well to result in long-lived stands. Well adapted for early spring grazing, sometimes as much as four weeks ahead of crested wheatgrass, but becomes unpalatable earlier than most grasses. It has relatively low seedling vigor and requires as much as 4 to 8 years to reach full productivity. Because young plants are easily pulled up, grazing should be deferred until roots are well anchored. Recommended sites include intermediate and favorable sagebrush sites, sunny places on mountain brush and ponderosa pine ranges, and meadows at lower elevations. Adapted where effective environment is comparable to 9 to 15 inches precipitation. Planting depth 1/4 to 1/2 inch. Adapted variety, 'Sherman'. Average seeds/ft^2 at 1 lb. rate 21. Recommend pure stand rate 3 lb/ac.

Bluegrass, Canby *Poa canbyi*

A long-lived native bunchgrass. This grass makes vigorous early spring growth making it well adapted to spring grazing. Where season-long moisture is available, it is commonly crowded out by other species and is difficult to establish. It thrives on short season moisture and sets seed and goes dormant in late spring. Dormant plants are very drought resistant. Recommended sites include dry, shallow and rocky well drained soils in the sagebrush, and ponderosa pine areas. Adapted to the 9 to 15 inch precipitation environments. Planting depth 1/4 inch or less. Adapted variety, 'Canbar.' Average seeds/ft^2 at 1 lb. rate 21. Not recommended in pure stands.

Aberdeen, Bridger and Pullman PMCs currently have initial evaluation studies of ecotypes of *Poa secunda* complex including big, canby, Nevada and sandberg bluegrass.

Bluegrass, Canada *Poa compressa*

A low growing introduced bluegrass with short rhizomes and tolerance to shade, adapted to areas of low fertility and medium acid soils. Growth occurs in the early spring providing good ground cover. This attractive low maintenance plant provides excellent ground cover and erosion control on roadsides, ditch banks, borrow pits, dam sites, under trees and recreational areas. Planting depth, 1/4 to 1/2 inch. Adapted varieties are 'Canon' and 'Rubens'. Average seeds/ft^2 at 1 lb. rate 57.4. Recommended pure stand rate 1 lb/ac.

Bluegrass, Kentucky *Poa pratensis*

A major lawn and turf grass, introduced from Europe, adapted to cool climates and moist growing conditions. This species has relatively low herbage production and should not be planted for pasture. It commonly out-competes desired species on irrigated pasture and along riparian areas when poor grazing management has occurred due to its low growing point which makes it very resistant to over grazing. It is an excellent erosion control species in appropriate areas and may be recommended for small acreages where no management exists. Do not plant in riparian areas, wetlands, irrigated pasture and native meadows. Kentucky bluegrass requires 18 inches of annual precipitation or irrigation. Plant at 1/4 inch or less depth. Adapted varieties, Newport, Cougar, and Troy were developed in the northwest and many others are available. Average seeds/ft^2 at one pound rate 50. Recommended seeding rate for turf applications 4 lb/ac.

Brome, Meadow *Bromus erectus*

Previously known as *Bromus biebersteinii* this perennial long-lived, introduced bunchgrass reaches full productivity in 2 to 3 years. Seedling vigor is strong and palatability to livestock and wildlife is excellent. Use in pasture and hay seedings under irrigation or non-irrigated areas where precipitation is above 14 inches annually. It is moderately shade tolerant, winter hardy, recovers quickly after grazing, and is well adapted to mountain brush, aspen, conifer forest and subalpine sites in mountain valleys and plains. It does not go dormant under high summer temperatures as does smooth brome. It is an excellent choice in areas that are prone to early to late spring frost. Planting depth 1/4 to 1/2 inch. Varieties include 'Fleet', 'Paddock' and 'Regar'. Average seeds per ft^2 at 1 lb. rate 1.8. Recommended pure stand rate 12 lb/ac.

Brome, Mountain *Bromus cartinatus* or *marginatus*

A short-lived vigorous native bunchgrass which reaches full productivity in 1 to 3 years. It volunteers well in some situations, is moderately palatable, shade tolerant and valuable for quick cover. Will be replaced by long-lived species in mixtures and is susceptible to seedhead smut. Recommended sites include mountain brush, aspen, conifer forest and subalpine areas in mountain valleys and plains at medium to high altitudes and timber burns with 16 inches or more annual precipitation. Planting depth 1/4 to 1/2 inch. Adapted variety, 'Bromar'. Bridger and Meeker PMC's are nearing release on an accession that is smut resistant. Average seeds per ft^2 at 1 lb. rate 2.1. Recommended pure stand rate 12 lb/ac.

Brome, Smooth *Bromus inermis*

A long-lived, introduced sod-forming grass. Very palatable, productive, and shade tolerant. Seedlings are often weak, but once established, plants spread vegetatively to provide full stands. It has notable ability to suppress reinvasion of undesirable vegetation. Recovery is slow when cut for hay, and tendencies for sod binding requires occassional ripping and high fertility. A very useful plant for erosion control seedings. Southern strains (Lincoln) are best for mountain brush and favorable sites in the sagebrush and pinyon-juniper zone. Intermediate strains (Manchar) have been best on foothill to mountain rangelands. Planting depth 1/4 to 1 /2 inch. 'Manchar' is recommended for forage plantings on meadows, hay or pasture. 'Lincoln' is recommended for erosion control and waterways, and produces less forage but is more aggressive in vegetative spread than 'Manchar'. Average seeds per ft^2 at 1 lb. rate 2.9. Recommend pure stand rate 8 lb/ac.

Fescue, Creeping Red *Festuca rubra*

A major lawn and turf grass that is long-lived, slow developing, low growing, weakly rhizomatous, very competitive, fine leaved introduced grass from Europe. Chewings and slender creeping fescue are subspecies of creeping red fescue. They performs best on acidic soils and increases in overall production as acidity increases. They are most commonly used as turf grasses and sometimes used for erosion control and roadside stabilization. They requires at least 18 inches of precipitation. 'Fortress' and 'Illahhe' are adapted varieties and others are commercially available. Average seeds per ft^2 at 1 lb rate 14.1. Recommended seeding rate for turf applications 4 lb/ac.

Fescue, Hard *Festuca ovina duriuscula*

A very fine leaved, low growing, introduced bunch grass with fair palatability to livestock. A dense voluminous root system may encourage increased rodent populations. It is widely used for turf, highway plantings, airport strips, burned over timberland and reclamation areas where a long-lived, persistent, competitive ground cover is needed, in areas having an excess of 13 inches precipitation. Seedlings are slow to establish but persist through the development of abundant fibrous roots. Planting depth 1/4 to 1/2 inch. 'Durar' is the adapted variety. Average seeds per ft^2 at 1 lb. rate 13.0. Recommended pure stand rate 3 lb/ac.

Fescue, Idaho *Festuca idahoensis*

A long-lived, native, perennial bunchgrass. It has fine leaves and stems which grow primarily from the base. It is a palatable grass in spring, cures well on the stem and makes good fall forage. It commonly greens up in fall with rain. Idaho fescue occurs abundantly on north exposures in areas with 14 inches and above rainfall and is best adapted to areas above 16 inches precipitation. It prefers medium textured soils but is also found on coarser textured soils with steep north slopes. Planting depth 1/4 to 1/2 inch. 'Joseph' and 'Nezpurs' are adapted varieties, but are very difficult to establish. Average seeds/ft^2 at 1 lb. rate 10.3. Recommended pure stand seeding rate 3 lb./ac.

Fescue, Sheep *Festuca ovina*

A long-lived short statured introduced bunchgrass with short leaf blades. It is more drought tolerant than other fescues. Top production is low, but ground cover and root production are excellent. It is used for turf, highway plantings, airport strips, burned over timberland and reclamation areas where a long-lived, persistent, competitive ground cover is needed. Sheep fescue is best adapted to 10-18 inch precipitation zones, but has been established and is reproducing in the Red Desert of Wyoming with 5-9 inches of precipitation. A very good erosion control and understory species that competes well with weeds. Adapted varieties are 'Covar' and 'Bighorn'. Average seeds per ft^2 is 15.6 at a 1 lb. rate. Recommended pure stand rate is 3 lb/ac.

Fescue, Tall *Festuca arundinacea*

A long-lived, high producing introduced cool-season bunchgrass suited for use under a wide range of soil and climatic conditions. It is tolerant of acid to alkaline conditions and has less palatability than other pasture grasses, which may be grazed out of a stand if mixed with it. Suited to irrigation, subirrigation, or moderately wet conditions, as well as dryland areas where the effective precipitation is over 18 inches. Best suited for moist alkali areas in lowlands. Also a high producer in open aspen and subalpine ranges. Planting depth 1/4 to 1/2 inch. Adaptable varieties include 'Alta', 'Fawn', and 'Forager'. 'Kenhy' is a hybrid of tall fescue and perennial ryegrass. It is more palatable than regular strains of tall fescue, but retains its wide adaptation and resiliency. NOTE: Fungal endophyte problems can develop in livestock foraging on tall fescue. This problem can be greatly reduced, if not eliminated, by seeding with endophyte-free seed (production may be lower with endophyte free plants). Average seeds per ft^2 at 1 lb. rate 4.8. Recommend pure stand rate 5 lb/ac.

Foxtail, Creeping *Alopecurus arundinaceus*

A long-lived, cool-season, dense sod-forming introduced grass that is adapted to wet pasture sites. It has low seedling vigor, but once established spreads readily by rhizomes. Growth begins early in the spring, and leaves remain green until after hard frosts in the late fall. It is very cold tolerant and can persist in areas where the frost-free period averages less than 30 days. It is only moderately salt tolerant but produces good quality forage on wet fertile sites where it is usually superior to other wet area pasture grasses such as reed canarygrass and timothy. Cultivars of this species are 'Retain' and 'Garrison'. NOTE: Seed is very light and difficult to seed without the use of rice hulls or cracked corn. Planting depth 1/4 to 1/2 inch. Average seeds per ft^2 at 1 lb. rate 20.6. Recommend pure stand rate 3 lb/ac.

Hairgrass, Tufted *Deschampsia cespitosa*

A native perennial warm season grass found along streams, moist meadows, lakes and wetlands. Potential uses include streambank, shoreline, and wetland enhancement and reclamation stabilization. It is slow establishing, but long-lived with moderate production. Varieties include 'Norcoast' and 'Peru Creek', a released cultivar from Meeker PMC with adaptation in soils with a PH of 3.0 to 7.8. Additional work is being conducted at Corvallis PMC. Average seeds per ft^2 at 1 lb rate 55. Recommended seeding rate 1.0 lb/ac. Not recommended in pure stands.

Junegrass, Prairie *Koeleria cristata*

A long-lived, cool season, tufted, native perennial grass. One half to two feet in height. This species prefers deep to very deep silty to sandy soils and is rarely found in high percentages under natural conditions. It does best at 12-20 inches annual precipitation. No released cultivars are available, but limited quantities are sold commercially. As with all native plant collections you should request "source identified" seed. Average seeds per ft^2 at 1 lb rate 53. Seeding rate 1 lb/ac. Not recommended in pure stands.

Needlegrass, Green *Stipa viridula*

A cool season, medium fine-leaved native bunchgrass. It is moderately palatable to livestock and wildlife. It can tolerate short term flooding and has good drought tolerance in the 12-20 inch precipitation zone. Widely adapted from Alberta to New Mexico. Adapted to a wide range of soils, most often clayey soils. 'Lodorm' is a recent release. Average seeds per ft^2 at 1 lb. rate 4.2. Recommend pure stand rate 7 lb/ac.

Needle and Thread *Stipa comata*

A cool season, tufted, perennial, native bunchgrass, 1-3 feet tall. Adapted to fine sandy loam to sandy soils in the 7-16 inch precipitation zone. This species is a fairly early vegetative component on sand dunes in the intermountain region. Used for grazing in spring and winter following disarticulation of seed. The long awn attached to the seed can cause injury to livestock. No cultivars are available, but several PMCs are evaluating accessions. Native collections specify "source identified" seed. Average seeds per ft^2 at 1 lb rate 3.4. Seeding rate 7 lb/ac.

Needlegrass, Thurbers *Stipa thurberiana*

A medium height, cool season, native bunchgrass. It is very drought tolerant and often found on rocky sites and southern exposures in the 8-14 inch rainfall zones. It has fine leaves and is fair to good forage in the spring and fall. It is currently in the initial evaluation phase at Aberdeen PMC and with USFS in Provo, Utah. Native collections specify "source identified" seed. Average seeds per ft^2 at 1 lb rate 3.4. Seeding rate 7 lb/ac.

Orchardgrass *Dactylis glomerata*

A long-lived, high producing, introduced bunchgrass, adapted to well drained soils. A very shade tolerant plant that is highly palatable to livestock and wildlife, especially in the early part of the season. It is a widely preferred species for hay, pasture, or silage. It is less winterhardy than meadow or smooth brome or timothy and is more vulnerable to diseases than many pasture grasses. Orchardgrass is compatible in alfalfa and clover mixes. It can be grown under irrigation or on dryland where the effective precipitation is 16 inches or more. It is also used in erosion-control mixes primarily for its forage value. Planting depth is 1/4 to 1/2 inch. Varieties are early-, mid-, and late-season in maturity. Late-season varieties are preferred in mixture with alfalfa.

Early - `Hallmark', 'Potomac'; Mid - `Akaroa', 'Ambassador'; Late - 'Latar'.

'Paiute' is a dryland orchardgrass which is more tolerant to drought than the other accessions. It is adapted to 15-16 inches of precipitation and more in the sagebrush-grass, juniper and mountain brush types. This species does best on soils with few limitations. Avoid shallow and sandy soils.

Average seeds per ft² at 1 lb. rate 12.4. Recommend pure stand rate 3 lb/ac.

Reed Canarygrass *Phallaris arundinecea*

A course, vigorous, productive, long-lived introduced sod grass of wide adaptation. It is frost tolerant and suited to wet soils (but also somewhat drought tolerant). Initial stands are often poor because of tardy germination and weak seedlings. Once established, it can withstand continuous water inundation for 70 days in cool weather. It invades wet areas along ditches, canals, and drains. Produces an abundance of spring foliage with tremendous annual yields on moist fertile soils, high in nitrogen and organic matter. Infertile soils promote sod binding problems. Mature stands prove to be very unpalatable, requiring close grazing and mowing management for quality production. The lack of palatability and poor animal performance often characterized by reed canarygrass may result from the presence of serveral toxic alkaloids in the forage. Breeding new varieties low in alkaloids is on-going in several breeding programs. Planting depth 1/4 to 1/2 inch. Adaptable varieties 'Ioreed' and 'Palaton'. 'Palaton' is the result of one breeding program to reduce the alkaloid problems in this grass. Average seeds per ft² at 1 lb. rate 11.6. Recommend pure stand rate 4 lb/ac.

Ricegrass, Indian *Oryzopsis hymenoides*

A perennial native bunchgrass adapted to sandy soils and dry desert ranges. Seed of most strains are very slow to germinate due to a thick seedcoat, which can be treated in sulfuric acid or with a cool moist stratification to improve germination. Untreated seed requires a greater depth of planting than most species to promote seed germination. Seedings should generally occur using dormant fall plantings. It is palatable, with the seed production enhancing forage value because of high protein and fat contents and is an excellent wildlife species. Good grazing management is necessary if stands are to persist. Recommended sites are sunny exposure with sandy or gravelly soils. Grows on raw subsoils from lowlands into high mountains. Planting depth can be up to 3 inches, depending on pre-treatments and soil types. 'Nezpar' is a variety with improved germination characteristics. 'Paloma' is best adapted to semidesert areas. 'Rimrock', a recent release from Bridger PMC was selected for better seed retension characteristics. ARS in Logan, Utah is working on additional selections. Average seeds per ft² at 1 lb. rate 3.0. Recommend pure stand rate 8 lb/ac.

Ryegrass, Hybrid *Lolium* cross

This species is very similar to perennial ryegrass in performance, but has demonstrated improved seedling vigor. It is compatible with long-lived grasses and legumes for erosion control and short term pastures. 'Astor' is a cultivar. Seeding rates above 3 lb/ac in mixtures retard the development of slower growing species.

Ryegrass, Perennial *Lolium perenne*

A relatively short-lived, rapid developing, vigorous perennial bunchgrass adapted to a wide variety of soil conditions. Can be grown under irrigation or on dryland where the effective precipitation is 15 inches or more. It does best where winters are mild but may perform adequately where they are severe with snow cover. Retards the growth of other perennials if seeded too heavily in a mixture. Has good recovery after grazing in the spring but tends to go dormant in summer. Suited for most acidic areas as a turf and in lowlands, hay or pasture. Planting depth 1/4 to 1/2 inch. Adapted varieties are 'Linn', and 'Manawa (H1)'. Tetraploids are also available and have shown promising results in tests at several locations. Most tetraploids are developed for short rotation pastures or green chop. These varieties include 'Bastian', 'Grimalda', and 'Reville'. Average seeds per ft^2 at 1 lb. rate 5.7. Recommend pure stand rate 5 lb/ac. Higher seeding rates in pure stands may be considered.

Sacaton, Alkali *Sporobolus airoides*

Alkali sacaton is a native, warm season, perennial grass that grows in large bunches, 1-3 feet tall. It sometimes forms a uniform cover and appears to be a sod type. It is slow establishing and adapted to areas with a high water table or areas which may be saline. Found in areas as low as 10" precipitation where high watertable is present. It is used mainly for erosion control, forage plantings and increased diversity in adapted areas. Two cultivars released for south western states include 'Salado' and 'Saltalk'. 'Saltalk' is not considered winterhardy. Average seeds per ft^2 at 1 lb rate is 40. Seeding rate: 3 lb/ac.

Squirreltail, Bottlebrush *Elymus elymoides*
Sitanion hystrix

A drought tolerant, cool season, native bunchgrass. It is short to medium sized, tufted and poor to fair forage. This species is often an increaser on improving rangeland. It is adapted to the 8-16 inch precipitation zones. It is hoped it will have attributes which will enable it to establish a foothold in annual rangelands dominated by cheatgrass or medusahead wildrye. The only release is 'Sand Hollow' released in 1996 by ARS in Logan, Utah. It is currently under evaluation at ARS in Logan, Bridger and Meeker PMCs and by the USFS in Provo, Utah. Average seeds per ft^2 at 1 lb rate 4.4. Seeding rate 7 lb/ac.

Switchgrass *Panicum virgatum*

Switchgrass is a perennial, tall, weakly sod-forming grass native to the midwest and the eastern great plains. It grows on a wide range of soil textures and is tolerant of wet acid soils and brackish marshes. It is an excellent wildlife cover, utilized as food (seed) by songbirds and make an excellent forage for livestock. There may be a niche for this species in the corn producing areas of the intermountain west under irrigation as a mid summer forage. It will probably not out produce other irrigated forage varieties including orchardgrass and meadow brome. Winter hardy cultivars including 'Blackwell', 'Cave-In-Rock', 'Dakotah' and 'Forestburg' are recommended. Average seeds per ft^2 at 1 pound rate 6.3. Seeding rate: 5 lb/ac.

Timothy *Phleum pratensis*

An introduced bunchgrass adapted to cool, humid areas. It performs well, with moderate to high yields, on wet fertile pasturelands; establishes cover quickly, volunteers readily on preferred sites, and is moderately palatable. Timothy hay is a premium feed for horses and is compatible in legume mixes. Severe damage can result from early grazing during moist conditions. It is adapted to high elevations where effective precipitation is 18 inches or more. Recommended sites include moist mountain sites, ponderosa pine zone and above. Can also be used for ground cover and erosion control on cut or burned-over timberland. Planting depth 1/4 to 1/2 inch. Adapted varieties are 'Climax', 'Mohawk'. Average seeds per ft^2 at 1 lb. rate 30.3. Recommend pure stand rate 3 lb/ac.

Wheatgrass, Beardless *Pseudoroegneria spicata inerme*
Agropyron inerme

A long-lived, drought tolerant, erect native bunchgrass. It differs from bluebunch wheatgrass in the absence of awns. It begins growth in early spring and readily greens up in fall following fall rains. It is very palatable, quality persists longer into growing season and yields equal to or exceed crested wheatgrass. Recommended sites include the 12-18 inch precipitation areas. It is best adapted to winter-wet and summer dry climates. Planting depth 1/4 to 1/2 inch. Adapted variety is 'Whitmar'. Average seeds/ft^2 at 1 lb. rate 3.1. Recommended pure stand rate 8.0 lb/ac.

Wheatgrass, Bluebunch *Pseudoroegneria spicata*
Agropyron spicatum

Long-lived, drought-tolerant, wide-spread native bunchgrass. It begins growth early in spring and again with the onset of fall rains. It is highly palatable and recovers rapidly after grazing but has low resistance to repeated grazing. Several years are required for stand to obtain full productivity. Recommended sites include foothills with 10-20 inches precipitation, sagebrush, ponderosa pine, mountain brush and juniper-pinyon ranges. Low plant vigor results in poor stands on sites above 6500 ft. elevation. Planting depth 1/4 to 1/2 inch. Adapted variety is 'Goldar' above 12" precipitation. 'Secar', previously considered to be bluebunch wheatgrass but found to be a subspecies of thickspike wheatgrass, is more vigorous and productive than bluebunch wheatgrass (See Snake River Wheatgrass) in lower (8-12") precipitation areas. Average seeds per ft^2 at 1 lb. rate 3.2. Recommend pure stand rate 8.0 lb/ac.

Wheatgrass, Crested *(AGCR) Agropyron cristatum*

A very long-lived, drought-tolerant, vigorous introduced bunchgrass. Similar to standard crested wheatgrass but shorter, earlier maturing, with finer stems and leaves. Establishes on similar sites (10-18" precipitation) as standard and reportedly grows more effectively than standard at higher elevations. This species does not persist as well as standard crested wheatgrass under severe drought conditions. Planting depth 1/4 to 1/2 inch. Adapted varieties, 'Douglas', 'Fairway' and 'Ephraim'. Other cultivars available but less adapted include 'Parkway', 'Kirk' and 'Ruff'. Average seeds per ft^2 at 1 lb. rate 5.8. Recommend pure stand rate 5.0 lb/ac.

NOTE: 'Ephraim', is a tetraploid variety of *A. cristatum* that is weakly rhizomatous in higher rainfall areas. A recent release by ARS 'Douglas' crested wheatgrass is the first hexaploid on the market. It is characterized as having larger seed, broader leaves and stays green longer than other types mentioned above. It also establishes easily, but produces less. Because it stays green longer than other types, it is a preferred forage selection. It is not as drought resistant as Nordan or Hycrest types. Seeding rate: 5 lb/ac.

Wheatgrass, Crested (Standard) *AGDE2 Agropyron desertorum*

A very long-lived, drought tolerant bunchgrass adapted to a wide range of sites and precipitation zones as low as 8-10 inches. Growth begins early in the spring and again with fall moisture. Palatability is excellent in the spring and late fall; less during summer dormancy and after seed formation. It has very vigorous seedlings. Adapted to foothills with 8-16 inches precipitation, sagebrush, ponderosa pine, mountain brush, and juniper-pinyon ranges. Expect low vigor and poor stands above 6500 feet elevation. This species is more drought tolerant than fairway type crested wheatgrasses. Planting depth 1/4 to 1/2 inch. Adapted varieties are 'Nordan' and 'Summit'. Average seeds per ft^2 at 1 lb. rate 4.2. Recommend pure stand rate 5 lb/ac.

Wheatgrass, Hycrest Crested *Agropyron cristatum x Agropyron desertorum*

A hybrid cross between standard and induced tetraploid fairway crested wheatgrass. Seedlings are extremely vigorous during gemination and early establishment. Survives under greater competition and lower precipitation than other crested wheatgrasses. Yields more forage (15-20%) in younger stands; is an outstanding seed producer, but more stemmy. Occupies same sites as standard and Fairway crested. Especially useful in drier sagebrush, cheatgrass sites. Has established and survived in areas with 6-8 inches precipitation, but is not recommended below 8 inches. Planting depth 1/4 to 1/2 inch. The only cultivar is 'Hycrest'. Average seeds per ft^2 at 1 lb. rate 4.2. Recommend pure stand rate 5 lb/ac.

Wheatgrass, Siberian Crested *Agropyron sibericum*

Similar to standard crested wheatgrass. It has finer leaves, and retains its greenness and palatability later into the summer than other crested wheatgrasses. However, it yields less and has poorer seedling vigor than most crested cultivars. It occupies sites where standard crested wheatgrass will grow (7-12" precipitation) and is slightly more drought tolerant and is especially useful on juniper sites. Once established, it is reported to be well adapted to light, droughty soils and can withstand extended periods of drought better than other crested wheatgrasses. Planting depth 1/4 to 1/2 inch. Adapted varieties include 'P-27' and 'Vavilov' a recent release by ARS noted for better seedling vigor than 'P-27'. Average seeds per ft^2 at 1 lb. rate 4.9. Recommend pure stand rate 6 lb/ac.

Wheatgrass, Intermediate *Elytrigia intermedia*
Agropyron intermedium

A mild sod-forming, late maturing, long-lived, introduced grass, suited for use as hay and pasture, alone or with alfalfa on medium to fine textured soils. It begins to grow early in the spring and remains green and palatable into the summer, producing large amounts of quality forage. It does not mature seed at high elevations, but spreads vegetatively. Recommended from intermediate sagebrush sites into the high mountains up to 9000 feet and on dry meadows with 12-16 inches of rainfall. This species is excellent for situations where only one to two irrigations are possible. Useful on disturbed sites for soil stabilization. It is not shade tolerant. Planting depth 1/4 to 1/2 inch. Adapted varieties are 'Rush,' selected for excellent seedling vigor and forage quality; 'Greenar,' selected for forage production and compatibility with alfalfa; 'Reliant,' selected for disease resistance and production; 'Oahe' with improved seed production, forage yield, and rust resistance; 'Amur' selected for slightly more drought tolerance and 'Tegmar,' a low growing cultivar noted for erosion control, sod-formation and seedling vigor. Average seeds per ft^2 at 1 lb. rate 2.1. Recommend pure stand rate 12 lb/ac.

Wheatgrass, Newhy *Pseudotroegneria spicata x Elytrigia repens*
Agropyron repens x Agropyron spicatum

A hybrid cross between quackgrass and bluebunch wheatgrass. A mildly rhizomatous grass suited for use under a wide range of soil conditions. Begins growth early in the spring, retaining succulence and palatability for livestock later in the summer than many grasses. Some problems exist with seedling vigor and germination which may reduce initial stands; however, once established it becomes a very vigorous, high producing, high forage quality species capable of withstanding repeated grazing with good recovery. The hybrid is noted for tolerance to strongly alkaline soils and responds to irrigation, sub-irrigation or moderately wet conditions, as well as dryland areas where effective precipitation is over 14 inches. Adapted to foothills, intermediate sagebrush and juniper sites, higher mountain areas up to 8000 feet elevation, and on dry or wet meadows and pastures. Planting depth 1/4 to 1/2 inch. The only cultivar is 'Newhy' which was recently released. Average seeds per ft^2 at 1 lb. rate 3.0. Recommend pure stand seeding rate 8 lb/ac.

Wheatgrass, Pubescent *Elytrigia intermedia*
Agropyron tricophorum

A long-lived, aggressive sod-former adapted to low-fertility sites and coarse to medium textured soils. Similar to intermediate wheatgrass but slightly more drought-resistant, alkali tolerant, and somewhat less palatable. Is better adapted for pasture than for hay. Its ability to remain green during the summer, when soil moisture is limited, is a significant characteristic. Adapted to foothills with 11-16 inches precipitation, from intermediate sagebrush sites into the high mountains, but not in meadows and shady areas. Very useful for erosion control on a wide range of sites. Suggested varieties are 'Luna', most commonly used in Idaho and most drought tolerant of pubescent varieties. Others include 'Manska', 'Topar' and 'Greenleaf'. Average seeds per ft^2 at 1 lb. rate 1.8. Recommend pure stand rate 12 lb/ac.

Wheatgrass, Slender *Elymus trachycaulus trachycaulus*
Agropyron trachycaulum

A short-lived native bunchgrass with good seedling vigor and moderate palatability. It is valuable in erosion-control seed mixes because of its rapid development, salt tolerance, and compatibility with other species. It is well adapted as a cover crop to improve soil tilth and to increase organic matter in saline sites. It tolerates a wide range of conditions and adapts well to high altitude ranges and more favorable sites on mountain brush areas. Excellent in aspen and tall mountain brush. Planting depth 1/2 to 3/4 inch. 'Revenue' is a Canadian variety, selected for salinity tolerance, seed set, and forage yield. 'San Louis', a newly released variety, is adapted to high elevations. 'Pryor' is a recently released variety, selected for drought tolerance. Average seeds per ft^2 at 1 lb. rate 3.0. Recommend pure stand rate 6 lb/ac. Limit slender wheatgrass to 1 pound pls per acre in native mixes. Higher rates effect the establishment of slower developing native species.

Wheatgrass, Snake River *Pseudotroegneria spicata*
Agropyron dasystachum

A subspecies of thickspike wheatgrass, but similar in appearance to bluebunch wheatgrass. It is adaptable to most bluebunch wheatgrass areas but is more vigorous and productive in the lower (8-12" precipitation) areas adapted to bluebunch wheatgrass. (See bluebunch wheatgrass). The only variety is 'Secar'. Average seeds per ft^2 at 1 lb. rate 3.2. Recommend pure stand rate 8 lb/ac.

Wheatgrass, Streambank *Elymus lanceolatus*
Agropyron riparium

A long-lived, drought tolerant, creeping sod-former adapted to fine-medium textured well drained soils. Has excellent seeding vigor and is particularly well adapted to erosion control where effective precipitation is 10-25 inches. It has little value as a forage crop and is primarily used for stabilization of roadsides, ditchbanks, and lakeshores. It has also been used as a drought tolerant turfgrass, but care must be taken to not over irrigate or stand will be lost. Planting depth 1/4 to 1/2 inch. The only variety is 'Sodar'. Average seeds per ft^2 at 1 lb. rate 3.7. Recommend pure stand rate 7 lb/ac. (increase for turf applications)

Wheatgrass, Tall *Elytrigia elongata*
Agropyron elongatum

A long-lived, tall-growing, vigorous, very late-maturing introduced bunchgrass. Once established, it is very tolerant of salt, alkali and water table conditions. It starts growth early in the spring, reaching maturity in late summer. Reported to be the latest maturing of the wheatgrasses. Palatability is fair early in the growing season, but mature plants become very unpalatable and must be managed for use at earlier stages of growth. It does not stand continuous close grazing. Old course growth often makes current growth unavailable. Late standing material becomes good winter forage for livestock when used with supplemental protein sources. This grass has a very wide range of soil and climate adaptation and is a useful erosion control specie on critical areas. It is adapted to salty areas such as greasewood and saltgrass sites where the water table is from a few inches to several feet below ground surface. Also

intermediate and favorable sagebrush, mountain brush, and juniper sites where its drought tolerance is evidenced. Planting depth 1/4 to 3/4 inch. Adapted varieties are 'Alkar', 'Jose', and 'Largo.' Average seeds per ft^2 at 1 lb. rate 1.8. Recommend pure stand rate 12 lb/ac.

Wheatgrass, Thickspike *Elymus lanceolatus*
Agropyron dasystachum

A long-lived, native sod-forming grass widely distributed in the northern part of the Intermountain Region. It is characterized by drought tolerance, early spring growth, fair palatability, but low forage production. More drought tolerant than western wheatgrass, it is well suited for wind erosion control on coarse-textured soils. It is best utilized as forage when fully headed and low in nutritive value. Adapted to disturbed range sites and dry areas subject to erosion, roadsides, and waterways in the 10-18" precipitation zones. Planting depth 1/4 to 1/2 inch. Improved varieties include 'Bannock', 'Schwendimar', 'Critana' and 'Elbee'. 'Bannock' a new release for the Snake River and Great Basin areas was released in 1995 by Aberdeen PMC. Average seeds per ft^2 at 1 lb. rate 3.4. Recommend pure stand rate 8 lb/ac.

Wheatgrass, Western *Pascopyrum smithii*
Agropyron smithii

A long-lived, widely distributed, strongly rhizomatous, native grass. It begins spring growth later than most wheatgrasses and is typified by poor germination, low seedling vigor, and low production of low quality forage. Plantings usually result in scattered stands that spread in 3 to 4 years to site dominance. Western wheatgrass is the most aggressive native sodgrass available. Once established, it becomes very persistent and provides excellent soil binding for erosion control. It is particularly productive in clayey swales and waterways, with moderate to high salt tolerance. Adapted to lowlands with precipitation above 12 inches and most mountain brush areas. Planting depth 1/4 to 1/2 inch. Adapted varieties, 'Rosana' and 'Arriba'. Other releases include 'Barton', 'Flintlock', 'Rodan' and 'Mandan 456'. Average seeds per ft^2 at 1 lb. rate 2.2. Not recommended in pure stands. Recommended 50% mixed stand seeding rate 3.0 lb/ac.

Wildrye, Altai *Elymus angustus*

A winter hardy, drought resistant, long-lived, cool season bunchgrass, sometimes with short rhizomes. It is known to root to depths of 15 feet. Basal leaves are somewhat course, but very palatable and protein levels of 8 percent are common in standing winter feed. Adapted to moderately deep to deep loams to clay loams with 14 inch or greater rainfall. Can withstand saline conditions almost as well as tall wheatgrass. Seedlings develop slowly and good seedbed preparation and weed control is essential. 'Eejay', 'Pearl' and 'Prairieland' are released varieties. Average seeds per ft^2 at 1 lb. rate 1.33. Recommended pure stand rate 12 lb/ac.

Wildrye, Basin *Leymus cinereus*
Elymus cinereus

A slightly spreading, robust, native grass. It is tall, coarse, long-lived, low in palatability, but useful for calving pasture and wildlife forage cover. Poor seedling vigor usually results in sparse stands, but one of the highest producers once established. Mature plants are unpalatable and need to be managed for use at earlier periods with grazing management scheduled to avoid the high growing point. Great care must be taken to avoid close grazing or clipping which may result in heavy plant loss in a single season. Winter grazing with protein supplements utilize old coarse growth and allows more effective use of new growth. Adapted to saline or alkaline lowlands, flood plains, and deep clayey to loamy soils that receive more than 10-14 inches precipitation. Particularly well suited for many juniper areas; performs well throughout the mountain brush zone and in aspen openings. Plantings have been established and are reproducing in rainfall areas as low as 5 to 9 inches. Planting depth 1/2 to 3/4 inch. Adapted varieties 'Magnar' and 'Trailhead'. Average seeds per ft^2 at 1 lb. rate 3.0. Recommend pure stand seeding rate 8 lb/ac.

Wildrye, Beardless *Leymus triticoides*
Elymus triticoides

A long-lived, sod-forming native grass. It is adapated to wet or wet-saline-alkaline soils. Developed primarily for stabilization and cover on wet to wet-saline soils, this plant is one of the most salt tolerant species available. It is of secondary importance as a forage species due to its coarseness in later growth stages, but is considered productive when fertilized and use for winter grazing. Planting depth 1/4 inch or less in a firm weed free seedbed. Adapted variety 'Shoshone.' Average seeds per ft^2 at 1 lb. rate 4.2. Recommended pure stand rate 16 lb/ac. due to poor seedling performance.

Wildrye, Blue *Elymus glaucus*

A fast developing, short-lived, cool season bunchgrass native to north America. This species is typical to open woods, thickets and other areas which are semi-shaded in the 16 inch and above precipitation areas. This species is noted for its high seed production and rapid stand establishment for early erosion control in distured areas. Plant at 1/4 to 1/2 inch depth. Adapted variety 'Arlington'. Recommended pure stand rate is 10 lb/ac.

Wildrye, Mammoth *Leymus racemosus*
Elymus giganteus

A course introduced, drought tolerant, creeping rhizomatous grass. It is not palatable to livestock, but can provide good cover and may be useful for calving pastures and wildlife forage and cover. It is long lived on inland sand dunes and dredge spoils where it will stop sand movement and provide permanent cover. It is available as seed, but can also be propagated vegetatively. 'Volga' is a released cultivar. It was selected for superior performance in stabilizing inland sand dunes and critical areas on course textured soils. Average seeds per ft^2 at 1 lb rate 2.3. Seeding rate 10 lb/ac.

Wildrye, Russian *Psathyrostachys junceus*
Elymus junceus

A long-lived introduced bunchgrass. Grows rapidly in the spring and produces abundant basal leaves that remain green and palatable through summer and fall as long as soil moisture is available. It endures close grazing better than most grasses. It cures well on the stump (better than most cool season grasses) and makes excellent late fall and winter feed. Once established, withstands drought as effectively and is more palatable than crested wheatgrass. However, most varieties have been erratic in establishment, demonstrate poor seedling vigor, and provide poor soil protection. Adapted to sagebrush, mountain brush, and juniper-pinyon sites. Useful on soils too alkaline for crested wheatgrass and too dry for tall wheatgrass. Planting depth 1/4 to 1/2 inch; very sensitive to deeper placement. 'Vinall', an earlier variety, has poor seedling vigor and is not recommended. 'Swift' was selected for seedling vigor, and 'Cabree' was selected both for seedling vigor and reduced seed shattering. 'Bozoisky-Select', selected for increased seedling vigor and forage production. 'Mankota', selected for establishment from deeper seeding depths. Average seeds per ft^2 at 1 lb. rate 3.9. Recommend pure stand seeding rate 6 lb/ac.

Characteristics of Legumes and Forbs

Alfalfa *Medicago sativa*

A very productive, palatable perennial introduced legume with numerous varieties which have specific characteristics for given purposes. Suited for use as hay, pasture, or haylage under irrigation or on dryland where the effective precipitation is 12 inches or more. Does not persist with moderate to heavy grazing on rangeland unless rest periods occur. It is vulnerable to pocket gophers because of the taproot; however, creeping varieties are less susceptible to damage. Seedings can occur in the spring or late fall. Seed requires inoculation with nitrogen-fixing bacteria before planting. Adapted to intermediate and favorable sagebrush, juniper, mountain brush, and ponderosa pine sites. Does poorly at higher elevations. 'Ladak', 'Trevois,' 'Ranger', 'Spredor 3', and 'Nomad' are best varieties for low precipitation sites including juniper, sagebrush and mountain brush. 'Ranger' has persisted at 10,000 ft. elevation. ARS in Logan, Utah and USFS in Provo, Utah are currently working with alfalfa in hopes of selecting more drought tolerant rangeland varieties. Planting depth 1/4 to 1/2 inch; 1 to 3 pounds per acre in mixture with grass; 10-15 pounds for hay. Plant in a very firm seedbed. Average seeds per ft^2 at 1 lb. rate 5.1. Full seeding rate 5 lb/ac. Recommended 25% mixed stand rate at 1.5 lb/ac for pasture situations.

Aster, Blueleaf *Aster glaucodes*

A native perennial forb that commonly occurs in all vegetative types from the upper sagebrush-grass to the subalpine. This forb is generally found on exposed depleted and disturbed sites. It is one of the first forbs to green up in the spring, making it highly sought out by livestock and big game. The strong rhizomatous root system enables this species to be very useful in stabilization of disturbed and erosive areas and in withstanding considerable grazing and trampling. Fall seeding is preferred. Seed can be surface seeded on disturbed soil or to 1/2 inch deep. Average seeds per ft^2 at 1 lb. rate 12.4. Not recommended in pure stands.

Balsamroot, Arrowleaf *Balsamorhiza sagittata*

A broadleaf native perennial with a deep woody taproot that can be found growing on well-drained silty, loamy to granitic soils in sagebrush-grass, mountain brush, ponderosa pine, and on open sunny slopes in the aspen and coniferous forests. This forb is strongly drought-resistant, has good winter-hardiness, is tolerant of semishade, and strongly tolerant of grazing and trampling. Livestock and big game make extensive use of this forb, especially on spring ranges. It is very difficult to attain good stands of this species because of its extremely slow establishing characteristics which can take up to 8 years. Fall seeding is recommended. Seed can be drilled or broadcast but should be covered to 1/3 inch deep. Average seeds per ft^2 at 1 lb. rate 1.3. Not recommended in pure stands.

Burnet, Small *Sanguisorba minor*

A perennial winter-active forb, growing to 2 feet tall. It is semi-evergreen, moderate yielding and nonleguminous but deep rooted, and has good palatability. Growth is most vigorous in fall and spring. It is best adapted to well-drained soils in the sagebrush-grass and juniper areas. It can be grown on low fertility, droughty soils as well as moderately wet, acid soils. It establishes with ease but will not persist in most instances below 14 inches of precipitation. 'Delar' is a much improved forage yielding variety. Average seeds per ft^2 at 1 lb. rate 1.3. Recommended pure stand rate 20 lb/ac.

Clover Alsike *Trifolium hybridum*

A short-lived perennial legume that produces abundant palatable foliage on fertile soils. It is suited for hay or pasture under irrigation or on dryland where the effective precipitation is 18 inches or more. Is adapted for use on poorly drained, acid soils, especially in cool areas. Makes good meadow hay and is tolerant of moderately alkaline conditions. Planting depth 1/4 inch. Adaptable variety is 'Aurora'. Average seeds per ft^2 at 1 lb. rate 16.1. Recommended 25% mixed stand rate 1 lb/ac for pasture situations.

Clover, Red *Trifolium pratense*

Short-lived, perennial legume suited primarily for hay and silage under irrigation or on dryland where the effective precipitation is 25 inches or more. Requires well-drained soil. Produces best under medium acid to neutral soil conditions. It is compatible with white clover in pasture mixtures and will reseed itself and spread under favorable conditions. Planting depth 1/4 to 1 inch. Adapted varieties are 'Kenland', 'Dollard', 'Redman', and 'Reddy'. Average seeds per ft^2 at 1 lb. rate 6.3. Recommended 25% mixed stand rate 1.5 lb/ac for pasture situations.

Clover, Strawberry *Trifolium fragiferum*

A spreading, pasture-type, perennial legume suited for use under irrigation or semi-wet soils and strongly to very strongly sodic conditions. Less productive than white clover where the latter can be grown. 'Salina' is tolerant to winter flooding, making it a suitable legume for use adjacent to overflowing waterways. Average seeds per ft^2 at 1 lb. rate 6.9. Recommended 25% mixed stand rate 2 lb/ac for pasture situations.

Clover, White *Trifolium repens*

A long-lived, stoloniferous perennial legume suited primarily for pasture, but can also be used for hay and silage. Can be grown under irrigation or on dryland where the effective precipitation is 18 inches or more. Requires medium to high fertility and adequate moisture for optimum production. Is not tolerant of strongly acid or strongly alkaline conditions. Is tolerant of poor drainage. May present a bloat hazard when it represents a high percentage
of the pasture. Is a good erosion control plant on streambanks and roadsides, though usually lacking in persistence. White clover thrives best in a cool, moist climate in soils with ample lime, phosphate, and potash. In general, white clover is best adapted to

clay and silt soils in humid and irrigated areas. It grows successfully on sandy soils with a high water table or irrigated droughty soils when adequately fertilized. White clover is shallow rooted and seldom roots deeper than 2 feet which makes it adapted to shallow soils, when adequate precipitation or irrigation is available. There are three general types:

'Ladino' is the only variety of the large type. It is two to four times as large as common white clover. It will winter kill under dry winter conditions. It requires a high soil phosphate level and good management for maximum production. 'Pilgram' and 'Merit' have been developed for winter hardiness.

Intermediate - 'Grassland Huia' is representative of the intermediate type.

Small type - 'New York' wild white clover is an example of the small type which is adapted to higher elevations and colder areas. It is the most drought resistant type. It is very persistent in pastures, withstands close grazing, and is the least productive of the white clover. 'Kent Wild' white clover is also a small type.

Average seeds per ft^2 at 1 lb. rate 18.4. Recommended 25% mixed stand rate 1 lb/ac for pasture situations.

Crownvetch *Coronilla varia*

An introduced, long-lived perennial legume with a strong rhizome and a deep taproot system. This forb does well in mountain big sagebrush, mountain brush, and aspen communities with over 21 inches of annual precipitation. It prefers soils slightly acid to basic and does especially well in calcareous derived soils. It does not do well in poorly drained soils. This semi-evergreen forb is preferred by all classes of livestock and wildlife. The strong spreading fleshy rhizome enables this species to be an excellent soil stabilizer. Crownvetch does well seeded as a component of a mixture. It requires fall seeding 1/4 to 1/2 inch deep. Three improved varieties are available: 'Emerald', 'Penngift', and 'Chemung'. All do well in the mountain brush and aspen. 'Emerald' is the smallest in stature and produces less foliage; however, it is the most aggressive underground spreader. Average seeds per ft^2 at 1 lb. rate 18.4. Recommended 25% mixed stand rate 1 lb/ac for pasture situations.

Flax, Blue *Linum perenne lewisii*

A native perennial semi-evergreen forb that prefers well drained soils ranging from moderately basic to weakly acidic. It prefers growing in the open, but does have some shade tolerance. It is intolerant of poor drainage, flooding and high water tables. This species grows well in all three big sagebrush types, juniper and mountain brush communities. It has been successfully seeded in the salt desert shrub type. Flax does well seeded in mixtures with other species. It can be surface seeded on a disturbed seedbed and should not be seeded deeper than 1/8 inch. This semi-evergreen forb is eaten readily by livestock and big game especially during spring and winter. This species does well seeded on disturbed sites. 'Appar' was released for its superior forage and seed production and palatability to livestock and wildlife. Resent research has identified 'Appar' as a naturalized introduced blue flax from European origins. Average seeds per ft^2 at 1 lb. rate 6.4. Not recommended in pure stands.

Globemallow, Gooseberry Leaf and Scarlet *Sphaeralcea grossulariaefolia and S. coccinea*

Gooseberryleaf globemallow is a drought tolerant perennial native forb that occurs throughout juniper, sagebrush-rabbitbrush, shadscale and blackbrush communities. Greatest area of occurrence is between 8 and 12 inches annual precipitation. This species has been successfully seeded in the blackbrush, shadscale, juniper and sagebrush communities and on disturbed sites with basic soils. Fall seeding is recommended. Seed should not be planted deeper than 1/4 inch. Livestock and big game make fair to good use of this species. It greens up early in the spring and following fall storms. It is one of few forbs that can be successfully seeded on disturbed, exposed, eroded sites in harsh environments.

Scarlet globemallow is a native, low-spreading perennial with creeping rhizomes. This species has considerable drought resistance and establishes especially well on disturbed sites. It is an excellent soil stabilization species on harsh sites. Average seeds per ft^2 at 1 lb. rate 11.5. Not recommended in pure stands.

Milkvetch, Cicer *Astragalus cicer*

Introduced rhizomatous non-bloating legume which requires inoculation for successful planting. A heavy seed and forage producer, forage quality appears to nearly equal that of alfalfa. It is adapted to lowland areas that receive more than 14 inches precipitation. This species is slow to establish due to very hard seed; scarification of seed is recommended. Well adapted to sagebrush-grass, juniper and mountain brush, except in the shade of trees or tall shrubs. Planting depth 1/4 to 3/4 inch. Recommended varieties include 'Lutana', 'Monarch' and 'Windsor'. Average seeds per ft^2 at 1 lb. rate 3.1. Recommended 50% mixed stand rate 4 lb/ac for pasture situations.

Penstemon, Alpine, Firecracker, Palmer, and Rocky Mountain

Alpine Penstemon *Penstemon venustus*: A perennial, cool season native half shrub, with a strong taproot and woody base. The flowers are bright lavender to purple. Its natural habitat is from 1,000 to 6,000 feet elevation and 20-35 inches precipitation. It does best in full sunlight, on open slopes of mountains valleys and foothills. It does not tolerate poorly drained soils. Potential uses include erosion control, plant diversity and beautification on droughty sites. The 'Clearwater Selection' is a recent release of Alpine penstemon from Aberdeen PMC.

Firecracker Penstemon *Penstemon eatonii*: A perennial, erect, cool season native forb that has a fiberous root system, stems that are decumbent or reclining, leaves that are slightly pubescent, flowers on upright stems that are bright red and bloom in mid summer to fall. It is adapted to sagebrush, juniper and ponderosa pine zones at 3,300 to 8,000 feet elevation in 10-16 inch precipitation zones. It does best in full sunlight and can survive cold winter temperatures if snow insulates the plant. It does not do well in poorly drained areas. Potential uses include erosion control, diversity and beautification. The 'Richfield Selection' is a recent release of firecracker penstemon from Aberdeen PMC.

Palmer Penstemon *Penstemon palmeri*: A relatively short-lived semi-evergreen native forb that occurs in the blackbrush, sagebrush-grass and juniper types in basic and slightly acidic soils, on disturbed and exposed sites. It is a pioneering species and is

especially suited for seeding exposed, depleted, and disturbed sites. It has considerable potential as an ornamental. This species is readily sought out by big game and livestock during winter and spring months. It can be fall broadcast or drilled. Do not seed deeper than 1/8 inch. The only released variety is 'Cedar,' selected for its wide area of adaptation, winter succulence, forage production and preference of livestock and wildlife.

Rocky Mountain Penstemon *Penstemon strictus*: A perennial semi-evergreen native forb that occurs in the upper juniper, mountain big sagebrush, mountain brush, and open areas in aspen and coniferous forest. This species does well with over 15 inches annual precipitation and on rocky and sandy loam soils that range from weakly acidic to alkaline. It is eaten by livestock and wildlife. Ornamentally, this species has potential. Considerable use made of this species in seeding to stabilize depleted, disturbed, and eroded sites. Seed can be broadcast or drilled up to 1/8 inch deep. Fall seeding is recommended. The variety 'Bandera' was released for its long-lived and seed production characteristics.

A number of penstemons are seeded primarily for soil stabilization on depleted, disturbed and erosive areas and as ornamentals, but no releases have been made. These include Low penstemon (*P. humilis*), Rydberg penstemon (*P. rydbergii*) and Thickleaf penstemon (*P. pachyphyllus*). Average seeds per ft^2 at 1 lb. rate 13.8. Not recommended in pure stands.

Sagewort, Louisiana *Artemisia ludoviciana*

A perennial native rhizomatous forb that occurs in all vegetative types from the sagebrush up to and through the subalpine. This species does well on shallow, as well as deep, slightly acid to basic soils. It is seeded on various types of disturbances and plays an important role in providing initial soil cover and stabilization. It can be broadcast or drilled. Do not seed more than 1/8 inch deep. The variety 'Summit' was released for its vigorous rhizome activity, forage production and wide area of adaptation. Average seeds per ft^2 at 1 lb. rate 103.0. Not recommended in pure stands.

Sainfoin *Onobrychis viciaefolia*

A medium-lived introduced cool-season legume. Impervious to alfalfa weevil, non-bloating, early blooming, and not as productive as alfalfa. It is highly palatable, but has problems with stem and root rot resulting in stands that seldom live more than 10 years. Adapted to deep soils of medium texture, high lime, dryland and irrigated, and alkaline soils. Not tolerant to wet soils, high water table, or frequent irrigation. Adapted to areas with 14 inches or more precipitation. Good seedling vigor. Can be grazed or used for hay. Planting depth 1/2 to 3/4 inches. Plant in spring and fall. Adapted varieties are 'Eski' and 'Melrose' for dryland plantings, and 'Remont' for irrigated plantings. Average seeds per ft^2 at 1 lb. rate 0.4. Recommended 50% mixed stand rate 20 lb/ac for pasture situations.

Sweetclover, Yellow *Melilotus officinalis*

An introduced, tall, stemmy, deep rooted, biennial legume. Produces an abundance of forage the first two years and is commonly utilized as a cover crop for perennial seedings. Also reseeds and maintains good stands where perennials do not crowd it out and in years of above normal precipitation. Poor quality forage at mid to later growth stages. Adapted sites include sagebrush-grass to subalpine areas, moist salty lowlands, road cuts and road sidings. Maintains stands in grass where ample moisture is available. Suited for green manure under irrigation or on dryland where the effective precipitation is 15 inches or more. Contains Coumarin, a derivative of dicoumarol, a blood anti-coagulant. Death may occur in animals foraging on pure stands. Planting depth 1/4 to 1/2 inch. Adapted variety is 'Madrid'. Average seeds per ft^2 at 1 lb. rate 6.0. Recommended 25% mixed stand rate 1 lb/ac for pasture situations and 10% mixed stand rate 0.25 lb/ac for covercrop situations.

Sweetanise *Osmorhiza occidentalis*

An erect perennial aromatic native forb that grows to 4 feet tall. It can be found in cool, moist woods; moist hillsides, valleys and forest openings; and in the aspen, spruce fir and subalpine. It has considerable shade tolerance but also does well in open areas. Can be found in mixed communities and in pure stands. Seeding is best accomplished in the fall. Do not seed more than 1/4 inch deep. It does well seeded in mixtures with other species. It establishes easily and can spread fairly quickly from seed. Livestock and big game show particular fondness for this forb which remains green throughout the grazing season. Average seeds per ft^2 at 1 lb. rate 0.7. Recommended seeding rate 35 lb/ac.

Sweetvetch Utah *Hedysarum boreale*

Utah sweetvetch is a native perennial legume. There is considerable variation in this species occurring from the shadscale saltbush up to and including the subalpine zones, with 10 or more inches of precipitation on acidic and basic soils ranging from sands to heavy clay. Its deep taproots enable it to take advantage of deep soil moisture which results in considerable drought resistance and winter hardiness. Good results can be expected from direct seeding individuals or as part of a mixture. Seed should be extracted from the pod and fall seeded at least 1/8 inch to 3/4 inch deep. Livestock and big game graze this species whenever available. Spring green up occurs early, and basal leaves remain green throughout the winter. 'Timp' is a recent release from Meeker PMC. Average seeds per ft^2 at 1 lb. rate 0.8. Not recommended for pure stands.

Trefoil, Birdsfoot *Lotus corniculatus*

A long-lived, deep-rooted introduced legume suited for use as pasture or hay. Can be grown under irrigation or on dryland where the effective precipitation is 16 inches or more. Does not create bloat problems. Is very winterhardy and useful at high elevations. Is better than alfalfa for retaining high quality forage on mature growth. The decumbent and intermediate types are more tolerant to close grazing than erect types. Tolerant of poor drainage, this legume is quite vigorous and an excellent plant for erosion control, big game food, and beautification. Has some drought tolerance and does well in the upper half of the mountain brush, openings in aspen and also

irrigated pasture. Planting depth 1/4 to 1/2 inch. Adapted varieties are 'Empire' (decumbent growth), 'Leo', 'Maitland' and 'Kalo' (erect growth) and 'Dawn'. Average seeds per ft^2 at 1 lb. rate 10.8. Recommended 50% mixed stand rate 2 lb/ac for pasture situations.

Yarrow, Western *Achillea millefolium*

Western yarrow is a perennial native member of the sunflower family. It can be found from the valley bottoms to the subalpine zone. Greatest areas of occurrence are mountain brush, aspen, and open timber. It has some shade, drought, and grazing tolerance and can be found in sandy to loamy soils ranging from weakly basic to weakly acid. Yarrow spreads by seed and rhizomes; does an especially good job on disturbed and depleted areas. Fall seeding is recommended. Depth of seeding should not exceed 1/4 inch. Can be seeded with other species. Is easily transplanted. Average seeds per ft^2 at 1 lb. rate 63.6. Not recommended for pure stand

CHARACTERISTICS OF WOODY PLANTS

This list includes only those shrubs that may be used in pastureland, rangeland, woodland and native plantings. Desciptions for shrubs and trees commonly utilized for windbreak or shelterbelt plantings can be found in appropriate "Tree and Shrub Handbooks".

Bitterbrush, Antelope *Purshia tridentata*

Antelope bitterbrush is a native intricately branched shrub varying in stature from low prostrate forms to erect arborescent forms as tall as 15 feet. It normally occurs in well-drained, sandy gravelly, or rocky soils throughout upper sagebrush, juniper, mountain brush, ponderosa pine, and lodgepole pine zones. Seedlings are vigorous and compete well when seeded with herbs. It grows rapidly and furnishes considerable forage. Upright growth forms are heavily browsed during the winter. It is one of the principal species used in wildlife and range seedings. Antelope bitterbrush is an important browse plant for game animals, sheep, and cattle. This species maintains itself very well even under severe grazing conditions. 'Lassen' antelope bitterbrush is a large upright variety suited to neutral, especially granitic soils. Other varieties include 'Fountain Green' and 'Maybell'. Average seeds per ft^2 at 1 lb. rate 10.4. Not recommended for pure stands.

Buffaloberry, Silver *Shepherdia argentea*

A native shrub to short tree up to 15 feet tall of western North America. It is a deciduous shrub, often forming thickets, with dense ascending to erect thorny branches which are silvery when young. Roots are shallow, extensive, well branched and capable of fixing nitrogen. It readily suckers and is not too palatable to livestock. Wildlife utilize it for both food, cover and berries. It perfers well drained to seasonally wet medium to course textured soils in the 12-20" precipitation zones. It has weak drought tolerance, is winter hardy, intolerant of shade, and has fair fire tolerance due to its sprouting ability. It is used primarily for wildlife cover and food, diversity in rangeland, critical areas and is usually planted as container or bareroot stock. 'Sakakawea' is the only released cultivar.

Ceanothus or Snowbrush *Ceanothus velutinus*

A native of the Intermountain West, this shrub occurs in juniper, ponderosa pine, and aspen types on well-drained, medium-textured soils, often rocky and shallow; also weakly acid to weakly basic and mostly nonsaline soils. It has moderate shade tolerance, fair drought tolerance, and good grazing tolerance. Sought out by big game and livestock. Can be seeded in conjunction with other species. Should be seeded on a firm seedbed to 1/3 inch deep in the fall. Use in game range revegetation mixtures in sagebrush, mountain brush, and juniper types. Spreading habit, somewhat fire tolerant, and attractive flowers makes this species potentially useful in seedings or plantings for stabilizing disturbed soils and for roadside beautification. Average seeds per ft^2 at 1 lb. rate 2.2. Not recommended for pure stands.

Chokecherry *Prunus virginiana*

A native shrub common in moist sites like drainages, ditches, and road shoulders and in cool and moist foothill, mountain, and canyon habitats with 12 to over 30 inches annual precipitation. Adapted to a wide range of soil textures except dense clay; intolerant of poor drainage and prolonged spring flooding and high water tables. More common in silty or moderately acidic, moderately basic, and weakly saline soils. Aggressive root and sucker sprouting after fire. Moderate tolerance of grazing; used extensively by livestock and big game. Has good potential on disturbed sites as an ornamental and a windbreak specie. Can be transplanted and broadcast or drill seeded. Seed should be placed about 1/2 inch deep. Fall seeding is preferred. Average seeds per ft^2 at 1 lb. rate 0.1. Not recommended for pure stands.

Current, Golden *Ribes aureum*

A fast growing native shrub that may, under favorable conditions, reach 10 feet in height. It grows in several forms and produces considerable foliage. Grows best where the precipitation exceeds 12 inches, especially in the juniper and mountain brush zones. It is an excellent erosion control plant, because it spreads both vegetatively and by seed. It is commonly used in conservation and windbreak plantings. An attractive shrub that requires little maintenance, it is frequently used in recreational plantings around campgrounds, roadways, etc. It provides food (berries) and cover for upland game and year around browse for big game and livestock. It can be readily established by direct seeding and transplanting seedlings. Average seeds per ft^2 at 1 lb. rate 8.2. Not recommended for pure stands.

Dogwood, Redosier *Cornus stolonifera*

A medium sized, deciduous native shrub, with bright red twigs and stoloniferous root system. It prefers moist sites and is commonly found along perennial streams. White flowers appear in clusters in late May to mid June followed by white berries in the fall. The berries are utilized by birds. It is utilized as a riparian, streambank, wildlife and windbreak plant. Plant container or bareroot stock.

Kochia, Forage *Kochia prostrata*

A semi-evergreen perennial subshrub introduced from southern Eurasia. On many desert and semidesert ranges, in Russia, it is known as a valuable forage shrub often associated with crested wheatgrass. It has been seeded in the Western United States for the last 10 years as a forage and reclamation plant on semiarid locations.

Forage kochia is adapted to basic soils but not suitable for neutral or acid soils. Successful plantings have occurred on soils ranging from sandy loam to heavy clay, with the most successful plantings on heavier soils. This shrub develops a fibrous root system with a large deep tap root and has been established, with reproduction taking place, in areas that receive 5 to 27 inches of annual precipitation.

Forage kochia has demonstrated its adaptability to the juniper, basin big sagebrush, Wyoming big sagebrush, and greasewood-shadscale types. Important characteristics: ability to establish and persist on disturbed harsh soils, high salt and drought tolerance, tolerance of extreme temperatures (-25^{o}C to 104^{o}C), low oxalate levels (lower than

winterfat and fourwing saltbush), ability to spread rapidly from seed, high seed production, moderate shade tolerance, fair palatability for livestock and big game, food and cover for upland game birds, fair fire tolerance, compatibility with other perennials, competitiveness toward annuals, and ability to increase fall and winter forage quality of perennial grass stands. The lower one-third of the plant remains green and succulent year around. The upper stems and seed stalks turn brown to red and dry after seed shatter (November to December).

Protein content during winter (upper dry stems 6.1%, lower green stems 8.7%) is higher than what occurs in antelope bitterbrush and true mountain mahogany. Summer protein content has been found to be over 13%. Sheep, deer, and cattle find this shrub palatable year around. When established in annual communities such as halogeton or cheatgrass, forage kochia can compete with annuals by reducing their dominance, density, forage, and seed production. In perennial communities, this shrub fills in innerspaces but has not been observed to reduce the density of established perennials.

Direct seeding on rangeland is best accomplished in the fall or winter by broadcasting on top of disturbed or undisturbed soil. If drill seeded, seed should not be seeded deeper than 1/16 inch. Seeding can be in combination with other perennial species. One variety, 'Immigrant' has been released. The above descriptions are for 'Immigrant'. Average seeds per ft^2 at 1 lb. rate 9.1. Recommended seeding rate 3 lb/ac. It is generally not recommended in pure stands.

Mountain Mahogany *Cercocarpus species*

Two species of mountain mahogany are excellent native wildland shrubs for several purposes. Curleaf mountain mahogany (*C. ledifolius*) is an evergreen shrub or small tree up to 23 feet tall. True mountain mahogany (*C. montanus*) is a deciduous shrub generally less than 12 feet tall. Both species commonly grow in rocky, mountainous habitats in shallow soils, although true mountain mahogany, in particular, will also grow in more moist fertile soils of canyon bottoms. These species are very intolerant of fire. Both are valuable browse plants for game animals and livestock. Curlleaf mountain mahogany is mainly browsed in the winter, whereas true mountain mahogany is utilized year around. Both are among the most palatable of shrubs to all classes of browsing animals. However, both species are difficult to establish because their seedlings are vulnerable to herbaceous competition and browsing animals grazing them out. 'Montane' is a widely adapted variety of true mountain mahogany. There is no released variety of Curleaf mountain mahogamy. Average seeds per ft^2 at 1 lb. rate 1.3. Not recommended for pure stands.

Rabbitbrush, Rubber *Chrysothamnus nauseosus*

Rubber rabbitbrush is a native shrub usually 12 to 80 inches high, but varying from dwarf forms to types over 10 feet tall. Rubber rabbitbrush is composed of numerous subspecies (>20) and shows considerable morphological variation in size, stem, leaf, and flower characteristics. A common plant on plains, valleys, and foothills, it grows best in openings within the sagebrush, juniper and ponderosa pine zones in sandy, gravelly, or clay-alkaline soils. It vigorously invades disturbed sites such as burned-areas, roadcuts and overgrazed rangelands but gives way to other plants as the plant community matures. It is an excellent plant for controlling erosion because of its deep roots, heavy litter, and ability to establish on severe sites. It is used to seed mine disturbances, roadways and big game ranges. It establishes well when seeded with

grasses and forbs. The value of rubber rabbitbrush as browse varies greatly between subspecies and populations. In general, the white to grayish subspecies are more palatable to livestock and big game than green subspecies. Some populations have excellent nutritive quality characteristics. Rubber rabbitbrush is browsed little in the summer, more in the fall, and heaviest during the winter. Some populations of this species may have potential as a source of industrial chemicals (rubber, resin, etc.). Control of established, unwanted stands is often difficult. Average seeds per ft^2 at 1 lb. rate 16.0. Not recommended for pure stands.

Rose, Woods *Rosa woodsii*

A native shrub common in well-drained loamy to sandy soils on plains, foothills, and mountain sites. Tolerant of moderately acid to weakly basic but mostly non-saline soils. Most abundant in disturbed soils and open communities with reduced competition. Aggressive pioneer in abandoned fields, disturbed sites, gullies, riparian areas and land cuts and fills. Common in 12 to over 20 inches annual precipitation. Rose roots are shallow and much branched with plants spreading from rhizomes. Foliage moderately palatable to livestock and big game. Provides good cover and winter food for birds and small mammals, for erosion control, and as an ornamental. Related high potential species for roadside and critical site stabilization and beautification. Can be transplanted, drilled, or broadcast seeded 1/2 to 3/4 inch deep. Fall seeding is required. Average seeds per ft^2 at 1 lb. rate 1.0. Not recommended for pure stands.

Sagebrush, Big *Artemisia tridentata*

Big sagebrush with its 3 major subspecies (basin, Wyoming, mountain) is a widely occurring, landscape dominating native shrub ranging in height from 1.5 to 15 feet. The lower forms generally have several main stems arising from the base; the tall forms often have a single trunk. Big sagebrush grows in a variety of soils on arid plains, valleys, and foothills to mountain slopes. It is frequently associated with such shrubs as shadscale saltbush, rubber rabbitbrush, green rabbitbrush, fourwing saltbush, spiny hopsage, gray horsebrush, winterfat, broom snakeweed, antelope bitterbrush, snowberry, and serviceberry. Big sagebrush is one of the more nutritious shrubs on western winter game ranges. Palatability of the different populations of this shrub to mule deer, sheep, and other animals varies widely. It is one of the best shrubs available for use in revegetation of depleted winter game ranges in the intermountain area. Because big sagebrush establishes rapidly from both transplanting and direct seeding, it is useful for stabilizing washes, gullies, roadcuts, and other raw, exposed sites. It is widely seeded on large game improvement projects. Plants spread well by natural seeding and furnish considerable forage soon after seeding. 'Hobble Creek' is a robust, palatable form of mountain big sagebrush adapted to more than 14 inches precipitation and deeper soils. 'Gordon Creek' is a recent release of Wyoming big sagebrush adapted to 10-14 inches precipitation. Big sagebrush is aggressive and persistent and sometimes forms closed stands, which require thinning and rejuvenation. Average seeds per ft^2 at 1 lb. rate; Basin 57.0, Mountain 40.0, Wyoming 57.0. Not recommended for pure seedings.

Sagebrush, Black *Artemisia nova*

Black sagebrush is a small spreading, aromatic native shrub 6 to 8 inches or occasionally to 30 inches tall. It has a dull grayish-tomentose vesiture that causes most populations to appear darker than big sagebrush. It grows in dry, stony, shallow soils often over a caliche layer. Usually these soils are calcareous. Individual populations of black sagebrush are differentially palatable to wildlife and livestock. In general, black sagebrush is considered excellent winter forage for sheep, antelope, and deer. It is an aggressive natural spreader from seed and can be easily established by broadcast seeding. Because it usually grows on dry rocky sites, it is usually not a candidate for plant control. 'Pine Valley Ridge' is a recent release. Average seeds per ft^2 at 1 lb. rate 23.0. Not recommended for pure stands.

Saltbush, Fourwing *Atriplex canesens*

Fourwing saltbush is an upright native shrub from 1 to 7 feet tall depending on site conditions and genotype. It occurs as pistillate (female), staminate (male), or more rarely monoecious (female and male) bushes. The species grows widely in a variety of soil types from valley bottoms and plains to mountainous areas. It is well suited to deep, well-drained sandy soil, sand dunes, gravelly washes, mesas, ridges, and slopes, but vigorous plants have been found in heavy clays as well. It is frequently found intermixed with numerous shrub and grass species. Fourwing saltbush is one of the most valuable forage shrubs in arid rangelands because of its abundance, accessibility, palatability, size, evergreen habitat, nutritive value, rate of growth, and large volume of foliage. Its leaves, stems, and utricles provide browse in all seasons. It withstands extremely heavy browsing and often appears to be stimulated by use. Research indicates this species will resprout following fire. This species is also one of the most important shrubs for use in rehabilitation of depleted rangelands and in soil stabilization projects. It can be established by direct seeding and by bare root and container transplanting. The variety 'Rincon' is a productive strain best adapted to the big sagebrush and juniper zones but also does well in the more mesic portions of salt desert shrub areas. Another variety is 'Wytana', a natural hybrid of fourwing saltbush and Gardner saltbush, with lower stature is adapted to higher elevation and precipitation areas. Average seeds per ft^2 at 1 lb. rate 1.8. Not recommended for pure stands.

Serviceberry *Amerlanchier alnifolia*

Serviceberry is an erect deciduous native shrub 3 to 15 feet tall. It is an important shrub in the juniper zone, less so in the big sagebrush zone, and most productive and common in sloping moist habitats within or just below the ponderosa pine zone. Serviceberry is a valuable browse plant due to its fair-to-high palatability and ready availability to livestock and big game. It is browsed by cattle after mid-summer when the more palatable grasses and forbs have been grazed or have dried up. Big game use it chiefly in the fall and winter. The flesh fruits are sought by a wide variety of birds and mammals. Utah serviceberry (*A. utahensis*) is a similar species differing in its drier habitat, more pubescent and smaller leaves,and less succulent fruits. Seedlings and young plants grow slowly and can be suppressed by grasses and broadleaf herbs. Once established, both shrubs withstand heavy browsing. Average seeds per ft^2 at 1 lb. rate 1.0. Not recommended for pure stands.

Sumac, Skunkbush *Rhus trilobata*

This native shrub can be found on most soil textures. It is common on hot, dry, shallow rock, foothills and in well-drained soils. Well adapted to 10 to 20 inches annual precipitation. Thriftier in coarse-textured or disturbed soils and somewhat open communities. Moderately strong drought tolerance. Good fire and grazing tolerance. Has good potential as a stabilizer species on disturbed sites and as a windbreak species. Livestock and big game make some use of this shrub as forage. It is an excellent cover species for big game and upland game birds. It can be transplanted or direct seeded. 'Bighorn' is the only released variety. Seeding should occur in the fall at a depth of 1/4 to 1/2 inch deep. Average seeds per ft^2 at 1 lb. rate 0.5. Not recommended for pure stands.

Winterfat *Eurotia lanata*

Winterfat is an erect or spreading native subshrub that shows wide variation in stature from dwarf forms less than 8 inches in height to larger forms to 4 feet in height. The dwarf forms are herbaceous above a woody base; taller forms tend to be woody throughout. Winterfat is most abundant on lower foothills, plains, and valleys with dry subalkaline soils. The upright forms also grow intermixed with big sagebrush, juniper, and ponderosa pine. Winterfat is a superior nutritious winter browse for livestock and big game. Sheep, cattle, antelope, elk, deer, and rabbits utilize it. Even though it is relatively tolerant to grazing, overgrazing has greatly reduced and even eliminated winterfat on some areas. Winterfat seed maintains viability only for relatively short periods of time (6 months to 4 years) without special treatment. Seeds require an after-ripening period for maximum germination and germinate best at warm temperatures (77 to 80°F). Winterfat may be established by seed or by transplanting. However, young seedlings are generally vulnerable to spring frosts. The upright variety, 'Hatch', is widely adapted and produces rapid growth. Aberdeen PMC is currently working on a winter hardy variety. Average seeds per ft^2 at 1 lb. rate 2.6. Not recommended for pure stands.

TABLE 1
PLANT ADAPTATION
AND SEEDING RATES
PLANT MATERIALS TECHNICAL NOTE 24

COMMON NAME	LONGEVITY	SEEDLING VIGOR	CHARACTER	SEEDS/LB	1 LB/ACRE SEEDS/FT2	PRECIP	SOIL	DEPTH	RATE
Bluegrass, Big	Medium	Slow-Med.	Bunch	796,000	21	9-18	cl-sl	1/4-1/2	3
Bluegrass, Canby	Long	Slow-Med.	Bunch	926,000	21	9-15	c-sl	0-1/4	3
Bluegrass, Canada	Long	Slow-Med.	Sod	2,500,000	57	+18	cl-sl	1/4-1/2	1
Bluegrass, Kentucky	Long	Slow-Med.	Sod	2,156,000	50	+18	cl-sl	0-1/4	4
Brome, Meadow	Long	Med.-Rapid	Bunch	93,000	2	+14	c-sl	1/4-1/2	12
Brome, Mountain	Short	Med.-Rapid	Bunch	90,000	2	+16	c-sl	1/4-1/2	12
Brome, Smooth	Long	Very Rapid	Sod	125,000	3	+14	cl-sl	1/4-1/2	8
Canarygrass, Reed	Long	Med.-Rapid	Sod	506,000	12	+18	c-sl	1/4-1/2	4
Fescue, Hard	Long	Slow	Bunch	524,000	13	+14	c-sl	1/4-1/2	3
Fescue, Idaho	Long	V. Slow	Bunch	450,000	10	+16	cl-sl	1/4-1/2	3
Fescue, Red	Long	Slow	Sod	615,000	14	+18	c-sl	1/4-1/2	4
Fescue, Sheep	Long	Slow	Bunch	680,000	16	+10	c-sl	1/4-1/2	3
Fescue, Tall	Long	Med.	Bunch	200,000	5	+18	saline	1/4-1/2	5
Foxtail, Creeping	Long	Slow	Sod	841,000	21	+18	c-l	1/4-1/2	3
Hairgrass, Tufted	Long	Slow	Bunch	2,395,000	55	+18	c-sl	0-1/4	1
Needlegrass species	Long	Slow	Bunch	180,000	3-4	8-20	cl-sl	1/4-1/2	7
Orchardgrass	Long	Med.	Bunch	375,000	9	+16	c-sl	1/4-1/2	3
Ricegrass, Indian	Long	Med.	Bunch	128,000	3	+10	l-s	1/2-3	8
Ryegrass, Perennial	Short	V. Rapid	Bunch	248,000	6	+15	cl-sl	0-1/2	5
Squirreltail, B.	Long	Med.	Bunch	190,000	4	+8	cl-sl	1/4-1/2	7
Timothy	Long	Med.	Bunch	1,319,000	30	+18	c-sl	1/4-1/2	3
Wheatgrass, Beardless	Long	Med.	Bunch	126,000	3	+12	c-sl	1/4-1/2	8
Wheatgrass, Bluebunch	Long	Med.	Bunch	139,000	3	+12	cl-sl	1/4-1/2	8
Wheatgrass, Crested AGCR	Long	Rapid	Bunch	250,000	6	+10	c-sl	1/4-1/2	5
Wheatgrass, Crested AGDE2	Long	Rapid	Bunch	153,000	4	+8	c-sl	1/4-1/2	5
Wheatgrass, Crested X	Long	Rapid	Bunch	152,000	4	+9	c-sl	1/4-1/2	5
Wheatgrass, Intermediate	Long	Rapid	Sod	90,000	2	+12	cl-sl	1/4-1/2	12
Wheatgrass, Newhy	Long	Med.	Sod	131,000	3	+14	saline	1/4-1/2	8
Wheatgrass, Pubescent	Long	Rapid	Sod	80,000	2	+11	l-s	1/4-1/2	12
Wheatgrass, Siberian	Long	Med.	Bunch	163,000	4	+7	c-sl	1/4-1/2	6
Wheatgrass, Slender	Short	Rapid	Bunch	131,000	3	+10	c-sl	1/4-3/4	6
Wheatgrass, Snake River	Long	Med.	Bunch	138,000	3	+8	c-sl	1/4-1/2	8
Wheatgrass, Streambank	Long	Med.	Sod	153,000	4	+12	c-l	1/4-1/2	7
Wheatgrass, Tall	Long	V. Rapid	Bunch	79,000	2	+14	saline	1/4-3/4	12

TABLE 1 PLANT MATERIALS TECHNICAL NOTE 24

COMMON NAME	LONGEVITY	SEEDLING VIGOR	CHARACTER	SEEDS/LB	1 LB/ACRE SEEDS/FT2	PRECIP	SOIL	DEPTH	RATE
Wheatgrass, Thickspike	Long	Med.	Sod	133,000	3	+8	l-s	1/4-1/2	8
Wheatgrass, Western	Long	Med.	Sod	96,000	2	+12	cl-sl	1/4-1/2	6
Wildrye, Altai	Long	Slow	Bunch	68,000	2	+14	saline	1/4-1/2	12
Wildrye, Basin	Long	Slow	Bunch	125,000	3	+12	sil-sl	1/4-1/2	8
Wildrye, Beardless	Long	V. Slow	Sod	181,000	4	+14	saline	1/4-1/2	16
Wildrye, Blue	Medium	Med.	Bunch	125,000	3	+16	cl-sl	1/4-1/2	10
Wildrye, Mammoth	Long	V. Slow	Sod	85,000	2	+12	ls-s	1/4-1/2	10
Wildrye, Russian	Long	Slow	Bunch	140,000	3	+12	c-sl	1/4-1/2	6
Alfalfa	Med.	Med.	Erect	225,000	5	+14	sil-sl	1/8-1/2	5
Burnet, Small	Med.	Med.	Erect	42,000	1	+14	c-sl	1/8-1/2	20
Clover species	Short	Med.	Erect-Prost	300,000	7	+18	sil-sl	1/8-1	3-6
Crownvetch	Long	Med.	Prostrate	110,000	3	+21	sil-sl	1/4-1/2	10
Flax, Blue	Short	Slow-Med.	Erect	278,000	6	+10	sil-sl	0-1/8	5
Milkvetch, Cicer	Long	Slow	Erect	134,000	3	+15	c-l	1/4-3/4	8
Penstemon species	Med.	V. Slow	Erect	600,000	14	8-20	cl-sl	1/8-1/4	3
Sainfoin	Med.	Slow-Med.	Erect	18,000	-1	+14	sil-s	1/4-3/4	50
Sweetclover	Short	Med.-Rapid	Erect	260,000	6	+14	c-sl	1/8-1/2	4
Trefoil, Birdsfoot	Long	Slow	Erect	470,000	11	+18	c-s	1/4-1/2	4
Sweetvetch species	Med.	Slow	Erect	35,000	1	+10	cl-sl	1/8-1/4	20
Yarrow	Med.	Slow	Prostrate	2,770,000	63	+10	cl-sl	0-1/4	1
Bitterbrush, A.	Long	Slow	Shrub	18,000	-1	+10	cl-sl	1/4-1/2	60
Kochia, Forage	Long	Slow	Half-shrub	395,000	9	+8	cl-sl	0-1/4	4
Sagebrush species	Long	Slow	Shrub	2,500,000	50	8-16	cl-sl	0-1/8	1
Saltbush, Fourwing	Long	Slow	shrub	78,000	2	8-16	l-s	1/8-1/2	15
Winterfat	Long	Slow	Half-shrub	112,000	3	+8	limy	1/8-1/4	10

Note - most trees are propogated in nursuries and transplanted to site for best success.

Doug Fir	Long	Slow	Tree	38,000	1	+22	cl-sl	1/4-1/2	23
Juniper	Long	Slow	Tree	?	?	+12	sil-sl	1/4-1/2	?
Pine	Long	Slow	Tree	10,000	-1	+16	sil-sl	1/4-1/2	60
Spruce	Long	Slow	Tree	135,000	7	+22	sil-sl	1/4-1/2	8

TABLE 2
COMMON NAMES
RECOMMENDED CULTIVARS
PLANT MATERIALS TECHNICAL NOTE 24

COMMON NAME	RECOMMENDED CULTIVAR(S)
Bluegrass, Big	'Sherman'
Bluegrass, Canby	'Canbar'
Bluegrass, Canada	'Canon' and 'Rubens'
Bluegrass, Kentucky	multiple - turfgrass
Brome, Meadow	'Fleet', 'Paddock' and 'Regar'
Brome, Mountain	'Bromar' and unreleased 905308
Brome, Smooth	'Lincoln' and 'Manchar'
Canarygrass, Reed	'Ioreed' and 'Palaton'
Fescue, Hard	'Durar'
Fescue, Idaho	'Joseph' and 'Nezpurs'
Fescue, Red	multiple - turfgrass
Fescue, Sheep	'Bighorn' and 'Covar'
Fescue, Tall	'Alta', 'Fawn' and 'Kenhy' multiple other cultivars
Foxtail, Creeping	'Garrison' and 'Retain'
Hairgrass, Tufted	'Norcoast' and 'Peru Creek'
Needlegrass species	'Lodorm'
Orchardgrass	'Ambassador', 'Hallmark', 'Latar', 'Paiute' and 'Potomac'
Ricegrass, Indian	'Nezpar', 'Paloma' and 'Rimrock'
Ryegrass, Perennial	multiple - short-lived and high producing
Squirreltail, B.	'Sand Hollow'
Timothy	'Climax', 'Mohawk' and many others
Wheatgrass, Beardless	'Whitmar'
Wheatgrass, Bluebunch	'Goldar'
Wheatgrass, Crested AGCR	'Douglas', 'Fairway', 'Ephraim', 'Kirk', 'Parkway' and 'Ruff'
Wheatgrass, Crested AGDE2	'Nordan' and 'Summit'
Wheatgrass, Crested X	'Hycrest'
Wheatgrass, Intermediate	'Amur', 'Greenar', 'Oahe', 'Reliant', 'Rush' and 'Tegmar'
Wheatgrass, Newhy hybrid	'Newhy'
Wheatgrass, Pubescent	'Greenleaf', 'Luna', 'Manska' and 'Topar'
Wheatgrass, Siberian	'P-27' and 'Vavilov'
Wheatgrass, Slender	'Pryor', 'Revenue' and 'San Luis'
Wheatgrass, Snake River	'Secar'
Wheatgrass, Streambank	'Sodar'
Wheatgrass, Tall	'Alkar', 'Jose' and 'Largo'

TABLE 2 PLANT MATERIALS TECHNICAL NOTE 24

COMMON NAME	RECOMMENDED CULTIVAR NAME(S)
Wheatgrass, Thickspike	'Bannock', 'Critana', 'Elbee' and 'Schwendimar'
Wheatgrass, Western	'Arriba', 'Barton', 'Flintlock', 'Mandan', 'Rodan' and 'Rosana'
Wildrye, Altai	'Eejay', 'Pearl' and 'Prairieland'
Wildrye, Basin	'Magnar' and 'Trailhead'
Wildrye, Beardless	'Shoshone'
Wildrye, Blue	'Arlington'
Wildrye, Mammoth	'Volga'
Wildrye, Russian	'Bozoisky-Select', 'Cabree', 'Mankota' and 'Swift'
Alfalfa	multiple varieties available (taprooted and fiberous rooted)
Burnet, Small	'Delar'
Clover, Alsike	'Aurora'
Clover, Red	'Dollard', 'Kenland', 'Redman' and 'Reddy'
Clover, Strawberry	'Salina'
Clover, White	'Ladino', 'Grassland Huia', 'Kent Wild', 'Merit', 'New York' and 'Pilgram'
Crownvetch	'Chemung', 'Emerald' and 'Penngift'
Flax, Blue	'Apper'
Milkvetch, Cicer	'Lutana', 'Monarch' and 'Windsor'
Penstemon species	'Bandera', 'Cedar', 'Clearwater Selection' and 'Richfield Selection'
Sainfoin	'Eski', 'Melrose' and 'Remont'
Sweetclover	'Madrid'
Trefoil, Birdsfoot	'Dawn', 'Empire', 'Kalo', 'Leo' and 'Maitland'
Sweetvetch species	'Timp'
Yarrow	no release
Bitterbrush, A.	'Fountain Green', 'Lassen' and 'Maybell'
Kochia, Forage	'Immigrant'
Sagebrush, Basin	no releases
Sagebrush, Mountain	'Hobble Creek'
Sagebrush, Wyoming	'Gordon Creek'
Sagebrush, Black	'Pine Valley Ridge'
Saltbush, Fourwing	'Rincon' and 'Wytana'
Sumac, Skunkbush	'Bighorn'
Winterfat	'Hatch'

References

Forage Management (5th Edition), Dale Smith, Raymond Bela, and Richard P. Walgebach, 1986

Forages - The Science of Grassland Agriculture, Maurice E. Heath, Robert F. Barnes and Darrel S. Metcalfe, Iowa State University Press, 1985

Grasses and Legumes for Soil Conservation in the Pacific Northwest and Great Basin States, A.L. Hafenrichter et.al. USDA-SCS Handbook No. 339, April 1968

Grass and Legume Seed Production in Montana and Wyoming, Larry K. Holzworth and Loren E. Wiesner, Montana and Wyoming Soil Conservation Districts and USDA-SCS Special Report No. 12, 1985

Grass Varieties in the United States, W. Curtis Sharp, Agricultural Research Service - USDA, Agricultural Handbook No. 170, Nov. 1994

Idaho Forage Crop Handbook, R. D. Ensign and H. L. Harris, Idaho Agricultural Experiment Station. Bull. 547, May 1990

Montana Range Seeding Guide, Dr. Carl Wambolt, Cooperative Extension Service, Montana State University, Bulletin 347, May 1976

Perennial and Biennial Forage Crop Varieties for Montana, Montana Agricultural Experiment Station, Montana State University, Circular

Plant Materials for Use on Surface-mined lands in Arid and Semiarid Regions, Ashley A. Thornburg, SCS - USDA, SCS-TP-157 January 1982

Plant Species Data, USDA-SCS-Idaho, Unpublished Data, 6 pages

Range Seeding Guide, Bryant Gomm, Howard Horton and Kay Asay, USDA-ARS, Logan, Utah Not Dated

Salinity and Plant Productivity, Vol. I, D.L. Carter pages 122-130. Date Unknown

Utah Interagency Seeding Handbook, Utah Interagency Plant Materials Committee, First Draft 1988